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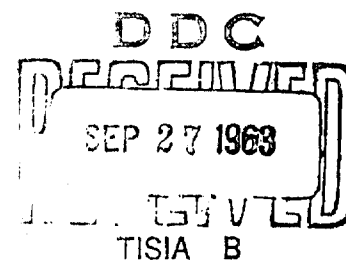
SAM-TDR-63-51

A SCREENING EXAMINATION FOR DETECTION OF  
GINGIVAL AND PERIODONTAL BREAKDOWN  
AND LOCAL IRRITANTS

TECHNICAL DOCUMENTARY REPORT NO. SAM-TDR-63-51

July 1963

USAF School of Aerospace Medicine  
Aerospace Medical Division (AFSC)  
Brooks Air Force Base, Texas



Task No. 775602

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<p>USAF School of Aerospace Medicine, Brooks AFB, Tex.</p> <p>SAM-TDR-63-51. A SCREENING EXAMINATION FOR DETECTION OF GINGIVAL AND PERIODONTAL BREAKDOWN AND LOCAL IRRITANTS. July 63, 10 pp. incl. illus., tables, 18 refs.</p> <p>Unclassified Report</p> <p>Methods of detecting gingival and periodontal breakdown and periodontal irritants were studied: (1) With a comprehensive periodontal examination used as a criterion, three screening examinations for the detection of periodontal disorders were evaluated. Two systems, the "mesial" and the "mesial plus distal" proved 94.1 and 98.0% accurate. (2) By use of the mesial screening system, inter- and intra-</p>	<p>1. Periodontal disease</p> <p>2. Periodontal detection system</p> <p>I. AFSC Task 775602</p> <p>II. T. J. O'Leary, Lt. Col., USAF, DC, et al.</p> <p>III. In ASTIA collection</p>	<p>1. Periodontal disease</p> <p>2. Periodontal detection system</p> <p>I. AFSC Task 775602</p> <p>II. T. J. O'Leary, Lt. Col., USAF, DC, et al.</p> <p>III. In ASTIA collection</p>	<p>USAF School of Aerospace Medicine, Brooks AFB, Tex.</p> <p>SAM-TDR-63-51. A SCREENING EXAMINATION FOR DETECTION OF GINGIVAL AND PERIODONTAL BREAKDOWN AND LOCAL IRRITANTS. July 63, 10 pp. incl. illus., tables, 18 refs.</p> <p>Unclassified Report</p> <p>Methods of detecting gingival and periodontal breakdown and periodontal irritants were studied: (1) With a comprehensive periodontal examination used as a criterion, three screening examinations for the detection of periodontal disorders were evaluated. Two systems, the "mesial" and the "mesial plus distal" proved 94.1 and 98.0% accurate. (2) By use of the mesial screening system, inter- and intra-</p>	<p>1. Periodontal disease</p> <p>2. Periodontal detection system</p> <p>I. AFSC Task 775602</p> <p>II. T. J. O'Leary, Lt. Col., USAF, DC, et al.</p> <p>III. In ASTIA collection</p>	<p>1. Periodontal disease</p> <p>2. Periodontal detection system</p> <p>I. AFSC Task 775602</p> <p>II. T. J. O'Leary, Lt. Col., USAF, DC, et al.</p> <p>III. In ASTIA collection</p>
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## **FOREWORD**

This report was prepared in the Dental Sciences Division by—

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The authors are grateful for the statistical help of Dr. M. Bryan Danford and Master Sergeant James I. Clogston, Biometrics Department; and for the technical assistance of Staff Sergeant David L. Sherwood and Airman Second Class William F. Baker, Dental Sciences Division.

## ABSTRACT

Methods of detecting gingival and periodontal breakdown and periodontal irritants were studied: (1) With a comprehensive periodontal examination used as a criterion, three screening examinations for the detection of periodontal disorders were evaluated. Two systems, the "mesial" and the "mesial plus distal" proved 94.1 and 98.0% accurate. (2) By use of the mesial screening system, inter- and intra-examiner consistency between examinations on the same individual was considered. (3) Agreement of the periodontists on scoring disease was checked. (4) General dentists were trained in the use of the mesial screening system and the system for scoring local irritants. After 8 hours of training, six dentists independently assessed 20 subjects on two occasions. With the chief investigator's score used as the criterion, the participating dentists failed to detect advanced gingival or periodontal disease in only 3 of 78 subjects. When failures to refer and wrong referrals were combined, errors by dentist ranged from 10 to 30%.

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This technical documentary report has been reviewed and is approved.

*Robert B. Payne*  
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Colonel, USAF, MSC  
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# A SCREENING EXAMINATION FOR DETECTION OF GINGIVAL AND PERIODONTAL BREAKDOWN AND LOCAL IRRITANTS

## 1. INTRODUCTION

Numerous studies (1, 2, 3) have documented the fact that dental caries and periodontal breakdown are the major causes of tooth loss. Dental caries is the more common cause in children and young adults, while periodontal breakdown becomes the primary cause in middle and later life (3, 4). Epidemiologic studies (5, 6) have shown that gingival inflammation is widespread between the ages of six and fourteen years and that its incidence decreases slightly after age fourteen. The untreated gingival lesion is believed by most investigators (7, 8, 9) to be the precursor of periodontal breakdown. When periodontitis is finally diagnosed, destruction is often so advanced that many if not all of the teeth must be sacrificed.

Consequently, a need exists for an effective "screening" type of examination which the general practitioner can employ in diagnosing gingival and periodontal breakdown. To be satisfactory, such an examination should meet the following requirements:

1. It must have definitive, easily understood criteria.
2. It must assess both the gingival and periodontal structures.
3. It must accurately detect the presence of gingival or periodontal disease requiring treatment.
4. The procedure must be such that it can be carried out within a reasonable time (4 to 6 minutes).
5. The examination must be of a nature that it can be readily taught to general dentists.

Preliminary clinical studies on 500 subjects interested the investigators in the potential of three screening systems—the "mesial," the "mesial plus the distal," and the "T" methods, for the detection of gingival and periodontal disease. A screening system for the detection and scoring of local irritants (materia alba, supragingival and subgingival calculus deposits, and overhanging restorations) was formulated because of the known importance (10, 11, 12) of these factors in the inception and progression of gingival and periodontal disorders.

This investigation was undertaken to determine:

1. The accuracy of the various screening examinations.
2. The agreement between periodontists in diagnosing conditions requiring treatment.
3. The degree of accuracy achievable by general dentists in detecting gingival and periodontal disease by use of a screening type of examination.
4. The agreement achieved by examiners in scoring the presence of foreign matter (materia alba, supragingival and subgingival calculus deposits, and overhanging margins of restorations).

## 2. METHODS AND MATERIALS

### Scoring

The numerical system advocated by Ramfjord (13) was employed for scoring gingival and periodontal status. In this system, gingival status is scored 0, 1, 2, or 3 while periodontal status is scored 0, 4, 5, or 6 with scores increasing with increasing severity of



disease. The mouth was divided into six segments:

1. Upper right terminal molar through first bicuspid (teeth Nos. 1 through 5).
2. Upper anterior area (teeth Nos. 6 through 11).
3. Upper left first bicuspid through terminal molar (teeth Nos. 12 through 16).
4. Lower left terminal molar through first bicuspid (teeth Nos. 17 through 21).
5. Lower anterior area (teeth Nos. 22 through 27).
6. Lower right first bicuspid through terminal molar (teeth Nos. 28 through 32).

Each segment is dried with compressed air and where necessary with cotton rolls. The segment is scored according to the following criteria:

*Assessment of gingival status.* A score of 0 is given when the gingival tissue is tightly adapted to the teeth and is of firm consistency with a physiologic architecture.

A score of 1 is given when slight to moderate inflammatory changes are present. These changes may include one or a combination of the following, involving one or more teeth in the segment, but *not completely surrounding* any one tooth:

1. Color changes from the normal pink to various shades of red.
2. Loss of normal consistency (firmness) of the tissue as evidenced by retraction of the gingival margin from the tooth for more than 1 mm. when tissue is dried with a firm blast of compressed air.
3. Blunting and slight enlargement of the marginal or papillary tissue when associated with color change or loss of consistency (items 1 and 2 above).

A score of 2 is given if the above-described changes, singly or in combination, are found *completely encircling* one or more teeth in the segment.

A score of 3 is given when marked inflammation is present including:

1. A loss of surface continuity (ulceration).

2. Spontaneous hemorrhage occurring when the tissue is thoroughly dried with a blast of compressed air or is lightly probed.

3. A loss of continuity of any interdental papilla from the buccal to lingual aspect.

4. Marked deviation from a normal gingival contour such as:

- a. Gross thickening of the marginal tissue (enlargement of gingival tissue covering more than one-third of the anatomic crown).
- b. Recession exposing the root surface.
- c. Clefts of the gingival tissue.

(NOTE: Destructive periodontal disease, as described in 4b and, often, 4c is scored as advanced gingival disease. This is permitted as the mesial and the mesial plus distal methods of scoring periodontal breakdown do not consider the facial and lingual surfaces.)

*Assessment of periodontal status.* In scoring, the cemento-enamel (C-E) junction is used as a fixed reference point. A Merritt periodontal probe is employed, and teeth are scored only if they are erupted to the occlusal plane.

To insure uniformity of scoring, it is of the utmost importance that the probe be directed in the long axis of the tooth. Erroneous readings are secured when the probe is directed at an angle. The proximal surfaces are probed at the mesial and the distal facial line angles. The facial and lingual surfaces are probed at the midpoint of the tooth mesial-distally.

Orientation of the C-E junction is necessary. If periodontal disease is present or has been present, the C-E junction may be exposed. The examiner must acquire an exact knowledge of the position of the C-E junction on the various surfaces of the teeth.

Teaching correct use of the probe and recognition of the C-E junction constitutes the most difficult and time-consuming phase of examiner training.

A score of 0 is given if the probe does not extend apically to the C-E junction. The gingival score is used for the segment.

A score of 4 is given if the probe extends up to 8 mm. apically to the C-E junction. (The gingival score is discarded.)

A score of 5 is given if the probe extends from 8 up to 6 mm. apically to the C-E junction. (The gingival score is disregarded.)

A score of 6 is given if the probe extends 6 mm. or more apically to the C-E junction. (The gingival score is disregarded.)

The highest score found is then recorded (fig. 1) for each dentulous segment and the sum divided by the number of segments to give the periodontal index.

*Assessment of local irritants.* The teeth in each segment are dried with compressed air and a half round (sickle) explorer is used to detect materia alba and calculus.

Materia alba or supragingival calculus is found by running the terminal  $\frac{1}{4}$  inch of the explorer over the buccal and lingual tooth surfaces. Subgingival deposits or overhangs are detected by exploring the crevicular areas with the lateral aspects of the terminal  $\frac{1}{4}$  inch of the explorer. Deposits, if present, give a gritty feeling or definite bumping sensation to the explorer.

A score of 0 is given if there is no detectable materia alba nor calculus either supragingival or subgingival.

A score of 1 is given if there is a slight amount of materia alba or calculus extending not more than 2 mm. from gingival margin.

A score of 2 is given if there is materia alba covering up to one-half the clinical crown or gross supragingival calculus.

A score of 3 is given if materia alba or supragingival calculus covers more than one-half the clinical crown or if subgingival deposits of calculus or overhanging restorations are detectable by probing.

After the highest score for each segment is recorded (fig. 1), the scores are added and

divided by the number of dentulous segments, and an index is obtained for the entire oral apparatus.

#### Screening methods tested

1. *T method.* Every tooth in each segment was evaluated for gingival status. Then six representative teeth (teeth Nos. 3, 9, 12, 19, 25, and 28) as suggested by Ramfjord (13) were evaluated on all four surfaces for the presence and extent of periodontal pocketing.

Segment No.	Teeth Nos.
1	1 - 5
2	6 - 11
3	12 - 16
4	17 - 21
5	22 - 27
6	28 - 32

The highest score recorded for gingival or periodontal status gave the score for that segment.

2. *Mesial method.* Every tooth in each segment was examined for gingival status. The mesial surface of each tooth was then probed for presence and extent of periodontal pocketing. The highest gingival (0, 1, 2, or 3) or periodontal score (0, 4, 5, or 6) was recorded by segment.

3. *Mesial plus distal method.* Every tooth in each segment was examined for gingival status. The mesial and distal surfaces of every tooth in each segment were then probed for the presence and extent of periodontal pocketing. The highest gingival or periodontal score was recorded by segment.

4. *Comprehensive method.* The status of the gingival tissue surrounding every tooth in each segment was evaluated. The four surfaces (mesial, facial, distal, and lingual) of each tooth in each segment were examined for the presence of periodontal pocketing. The highest gingival or periodontal score was recorded for each segment. In the mesial, the mesial plus

NAME (Last, First, MI)	GRADE	SERIAL NR	AGE	DATE
ORGANIZATION		DOCTOR		

PERIODONTAL INDEX							
UPPER RIGHT		1	2	3	UPPER LEFT	GPI	
	G						
	P						
LOWER RIGHT		4	5	6	LOWER LEFT		
	G						
	P						
IRRITANT INDEX							
UPPER RIGHT		1	2	3	UPPER LEFT	II	
LOWER RIGHT		4	5	6	LOWER LEFT		

FIGURE 1  
Scoring chart.

distal, and the comprehensive method of scoring, the highest score in the segment became the score for that segment; for example, in segment No. 1 composed of 5 teeth, if scores were 1, 2, 4, 5, and 3, the score for the segment would be 5.

### 3. RESULTS

#### Efficacy of scoring methods

It was assumed that examining all surfaces of all teeth would be the most accurate method for detecting periodontal breakdown. Results obtained by use of the comprehensive method were, therefore, taken as the standard for

comparison with results obtained by the T, the mesial, and the mesial plus distal method. This part of the investigation was carried out on 77 individuals, ranging in age from 18 to 54 years.

Evaluation of the scoring methods according to segments is given in table I. It should be noted that the mesial and distal method correctly classified 94.6% of the segments, the mesial method correctly classified 85.9%, and the T method correctly classified 70.1%.

Table II indicates the number of individuals who would be referred for specialized treatment on the basis of a periodontal score of 8 or

TABLE I

*Evaluation of scoring procedures according to number of segments correctly classified*

Method	Segments classified correctly	Segments classified incorrectly
T	324 (70.1%)	138 (29.9%)
Mesial	397 (85.9%)	65 (14.1%)
Mesial + distal	437 (94.6%)	25 ( 5.4%)

TABLE II

*Number of individuals correctly referred for specialized treatment*

Method	Correctly referred	Not referred
T	44 (86.3%)	7 (13.7%)
Mesial	48 (94.1%)	3 ( 5.9%)
Mesial + distal	50 (98.0%)	1 ( 2.0%)
Comprehensive	51 (100.0%)	0

A periodontal index of 3 or greater was used as the criterion for referral; 26 individuals out of a total of 77 had a high score of less than 3 in terms of all surfaces.

greater in any of the six segments of the mouth. The mesial method correctly referred 94.1% of the individuals; the mesial plus distal method, 98.0%; and the T method, 86.3%.

The correlation between the irritant (materia alba, calculus, and overhanging restorations) index and the periodontal index is shown in table III. There is a positive relationship between the four examination systems ( $P < .01$ ). It should be noted that the relationship between the periodontal score and the irritant index is not as strong for the older group (over 25) as it is for the younger group (25 and under).

#### Inter- and intra-examiner consistency

An effort was made to determine the consistency of findings by different examiners and in the repeated examinations by a single examiner of one individual. Two periodontists,

TABLE III

*Correlations between scoring methods and irritant index*

Method	Periodontal index $\bar{X}$	Irritant index $\bar{X}$	Correlation coefficients*
Total sample (N = 77)			
T	2.231		$r = .58†$
Mesial	2.470		$r = .62†$
Mesial + distal	2.608	1.999	$r = .64†$
Comprehensive	2.693		$r = .64†$
Age 25 and under (N = 55)			
T	1.735		$r = .48†$
Mesial	1.959		$r = .56†$
Mesial + distal	2.059	1.812	$r = .56†$
Comprehensive	2.132		$r = .57†$
Over 25 years (N = 22)			
T	3.473		$r = .31†$
Mesial	3.747		$r = .30†$
Mesial + distal	3.982	2.468	$r = .36†$
Comprehensive	4.096		$r = .35†$

\*Correlations between methods and irritant index.

†Correlation coefficients are significantly different from 0 ( $P < .01$ ).

on two separate occasions, evaluated the periodontal health of the same 20 subjects. They used the mesial method of scoring the gingival-periodontal index (GPI). The irritant index (II) was employed to assess the foreign debris present. Scores for each examination were obtained by computing the arithmetic mean of the segment scores. The differences between the first and second examinations as presented by the two periodontists and by the two variables, the periodontal index and the irritant index, are shown in table IV. Coefficients of variation are also given which is an index of percent error. It is evident that variation is similar for each investigator on the GPI variable in the total sample. Periodontist No. 2 showed more variability in assessment of the irritant index than did Periodontist No. 1. There were no differences between examinations for the same dentist and no difference between dentists on examining the same patient on the variables (GPI and II).

**TABLE IV**  
*Agreement within and between periodontists on GPI and II*

Periodontist	Variable	$\bar{X}$ 1st exam.	$\bar{X}$ 2d exam.	S.D.	C.V.
1	GPI	2.36	2.24	.261	11.1
2	GPI	2.46	2.44	.302	12.3
1	II	2.06	2.09	.202	9.8
2	II	2.18	2.30	.384	17.5

$$S.D. = \left( \frac{\sum d_i^2}{2n} \right)^{1/2} \quad (d_i \text{ is the difference between the scores of the first and second examinations}).$$

C.V. = Standard deviation divided by mean, expressed in percent.

**TABLE V**  
*Agreement on referral between periodontists*

Method	Agree on referral	Disagree on referral	Agree on nonreferral
Mesial	12	2	6
Comprehensive	15	1	4

A score of 8 or more in any segment was the criterion employed for referral.

#### Patient referral

To see if the separate periodontists would agree on patient referral, the two investigators independently assessed the gingival and periodontal status of 20 subjects. They used the comprehensive and mesial methods. A score of 8 or higher in any segment was to be the basis for patient referral (see table V).

The investigators disagreed on the necessity for referral of two subjects when employing the mesial method. On one subject, the disagreement occurred in scoring gingival disease while the second disagreement occurred in scoring periodontal breakdown. With the comprehensive method of scoring, the investigators disagreed on scoring periodontal breakdown on one subject.

These disagreements, found in incipient disease in young adults, re-emphasize the problems encountered in scoring degrees of

disease and the necessity for standardizing examiners before conducting studies.

*Use of mesial method by general dentists.*  
An attempt was made to determine the advisability of training general dentists to detect varying degrees of periodontal disease in a short period of time. The six dental officers asked to participate in the study had no specialized training in periodontics. Owing to practical considerations, instruction in the examination system was limited to three hours—two sessions of one and one-half hours each. The first session was devoted to the general problem of detecting periodontal disease employing the mesial method for assessing periodontal status. The second session was devoted to a demonstration of the examination procedures on patients presenting for routine treatment.

One week after the second training session, 20 subjects were examined by each of the participating dentists and the chief investigator. The same 20 subjects were examined a second time one week later by each of the participating dentists. In both examinations, each dentist scored each subject's mouth by segment, employing the periodontal index and the irritant index.

Table VI gives the mean GPI score for each examination and each dentist. The chief investigator examined the 20 subjects at the first appointment only. In terms of GPI the weakest relationship occurred with dentist E,

**TABLE VI**  
*Periodontal index means for each examiner and each examination*

Examination	A*	B	C	D	E	F	Chief investigator
1	2.490	2.905	2.474	2.480	2.646†	2.656	2.622
2	2.380	2.797	2.330	2.471	2.188‡	2.570	

\*The examining dentists are designated dentist A, dentist B, etc.

†First examination mean significantly different from second examination mean ( $P < .05$ ).

‡Mean differs significantly from chief investigator's mean ( $P < .05$ ).

**TABLE VII**  
*Agreement of dentists on patient referral*

Subject	Chief investigator	A*		B		C		D		E		F	
		1st exam.	2d exam.	1st exam.	2d exam.	1st exam.	2d exam.	1st exam.	2d exam.	1st exam.	2d exam.	1st exam.	2d exam.
1	R	N	N	R	R	R	R	R	R	R	N	R	R
2	R	R	R	R	R	R	R	R	R	R	N	R	R
3	R	R	R	R	N	R	N	R	R	R	R	R	R
4	R	R	R	R	R	R	R	R	R	R	R	R	N
5	N	R	R	N	N	N	N	N	N	R	R	N	N
6	R	R	R	R	R	R	R	R	R	R	R	R	R
7	R	R	R	R	R	R	R	R	R	R	R	R	R
8	R	R	R	R	R	R	R	R	R	R	R	R	R
9	R	R	R	R	R	R	R	R	R	R	R	R	R
10	R	R	R	R	R	R	R	R	R	R	R	R	R
11	R	R	R	R	R	R	R	R	R	R	R	R	R
12	N	N	N	R	R	N	N	N	R	R	N	N	R
13	R	R	R	R	R	R	R	N	R	R	R	N	R
14	R	R	R	R	R	R	R	R	R	R	N	R	R
15	N	N	N	R	R	N	N	N	N	N	N	N	N
16	N	N	N	R	N	N	N	N	R	N	N	N	R
17	N	N	R	R	R	N	N	N	N	N	N	N	R
18	R	R	R	R	R	R	R	R	R	R	R	R	R
19	N	R	N	R	N	R	R	R	N	R	N	R	R
20	N	N	R	R	N	R	N	R	N	R	N	R	R
Referred wrong		2	3	6	3	2	1	2	2	4	1	2	5
Failed to refer		1	1	0	1	0	1	1	0	0	3	1	1
Total error		3	4	6	4	2	2	3	2	4	4	3	6

\*The examining dentists are designated dentist A, dentist B, etc.

who had not received the full amount of training offered.

Since referral of patients needing specialized periodontal treatment was the most important aspect of this study, the six

participating dentists were compared on this basis (table VII).

Defining a "referral" as anyone who has a GPI of 3 or greater in any segment and using the chief investigator's score for each subject

TABLE VIII

*Percent success in scoring subjects under two criteria*

	A*	B	C	D	E	F
Percent success in referring patients requiring treatment (overreferrals counted as successes)	95.0%	97.5%	97.5%	97.5%	92.5%	95.0%
95% lower confidence limit	89.3%	93.4%	93.4%	93.4%	85.7%	89.3%
Percent success in referring patients plus overreferrals	82.5%	75.0%	90.0%	87.5%	80.0%	77.5%
95% lower confidence limit	72.6%	63.7%	82.2%	78.9%	69.6%	66.6%

\*The examining dentists are designated dentist A, dentist B, etc.

TABLE IX

*Irritant index means by dentist and examination*

Examination	A*	B	C	D	E	F	Chief investigator
1	2.590†	2.800†	1.964†‡	2.223	2.323	2.114	2.156
2	2.581†	2.949†	2.221‡	2.214	2.398	2.088	

\*The examining dentists are designated dentist A, dentist B, etc.

†Means differ significantly from chief investigator's mean ( $P < .05$ ).‡First examination mean significantly different from second examination mean ( $P < .05$ ).

as the criterion, we find that the participating dentists failed to refer only 8 subjects out of a total of 78 that should have been referred for specialized treatment in the first examination. When failure to refer and wrong referrals are combined, the error by dentist ranges from 10 to 80%.

The results of the second examination are similar in that the total number of referral errors by dentists ranges from 10 to 30%.

Table VIII shows the percent agreement between each examining dentist and the chief investigator under two criteria. Criteria 1 treated a failure to refer as a disagreement while criteria 2 treated both overreferral and failure to refer as disagreements. For the purpose of this analysis the result of examina-

tion 1 was combined with examination 2. The assumption was made that the events were independent and that the 40 examinations could be considered as coming from 40 different subjects. One-sided confidence limits are placed on each percentage success. We are 95% confident that the true percentage success is greater than this limit.

Under criteria 1, the percentage success by dentist ranges from 92.5 to 97.5% which is quite high. Under criteria 2, 75 to 90% of the patients are classified correctly. Criteria 2 is overly conservative since an overreferral cannot be considered as serious as failure to refer. It is reasonable to assume that further experience with the scoring system would tend to increase the percentage success.

The irritant index means achieved by the six participating dentists are compared with those of the chief investigator (table IX). Although results differ statistically from the chief investigator's in 5 of the 12, it is significant that 4 of the 5 differences are on the high side. This, as well as overreferrals in the periodontal examination, is a manifestation of the learning process, and a leveling out should be anticipated with increased experience of the examiners.

#### 4. DISCUSSION

A number of examination systems have been advocated for assessing gingival and periodontal health status.

1. The P.M.A. (papillary, marginal, and attached gingiva) index, as set forth by Massler et al. (6), is of value in recording gingivitis when employed by properly trained and standardized personnel. It is a time-consuming operation, however, that does not provide for recording loss of alveolar support.

2. The system employed by Marshall-Day et al. (14), combining clinical and radiographic survey, is extremely comprehensive. It, too, is time consuming and tedious; it, also, introduces the problem of securing and properly interpreting radiograms.

3. A periodontal index, suggested by Russell (15), is now widely employed in epidemiologic studies. This index places great emphasis on periodontal pockets and little emphasis on gingival disturbances. Lack of emphasis on gingival disturbances decreases the value of the Russell examination system in detecting early disease. Although valuable for epidemiologic studies, it may seriously underestimate the extent of disease in an individual.

4. Ramfjord (18) has advocated an examination in which six representative teeth are examined critically for gingival disease, presence and extent of periodontal pocketing, mobility, calculus, debris, lack of contact, and occlusal or incisal attrition. Numerical scores

are employed for the various findings, and indexes can be formulated for the individual. This system has great merit when utilized by small groups of well-trained examiners. The entire examination procedure is so comprehensive, however, that it would be difficult to secure satisfactory inter-examiner reproducibility with large groups.

5. Several epidemiologic studies (16, 17, 18) of periodontal disease have been carried out employing radiograms only. This method has an advantage in that it may disclose bone loss in an area that is ordinarily overlooked. However, investigation of field use of radiograms for periodontal diagnosis has disclosed such extreme variations in techniques of exposing and processing films that they are of limited value for diagnostic purposes. Radiographic examination alone leads to an incomplete diagnosis as it cannot assess the gingival lesion, the precursor of periodontal breakdown.

This investigation demonstrated that the mesial plus distal screening method was most effective, in comparison to the comprehensive method, in diagnosing gingival or periodontal breakdown requiring treatment. This could be anticipated, as this system sampled the largest number of surfaces for presence and extent of periodontal pocketing. The mesial method attained nearly the same efficiency (94.1% vs. 98.0%) in detecting breakdown requiring treatment and is considerably easier and less time consuming. Sampling of six representative teeth (the T method) did not prove as effective as the mesial plus distal or the mesial method. It should be noted, however, that the sampling was not carried out in the manner proposed by Ramfjord (18). In this investigation the gingival status of each tooth present in the mouth was evaluated, whereas Ramfjord evaluated the gingival status of six representative teeth.

It is obvious that any index of gingival or periodontal health derived from scoring systems employing the highest score in a segment will overestimate the severity of the problem in many instances. Whereas Ramfjord's system is designed to yield a representative score



for the oral apparatus, the screening examination is formulated to detect and localize disease requiring treatment. Therefore, the two systems cannot be readily compared. Considering the factors of accuracy, ease, and time of execution for the three screening methods, the mesial method was selected as the one of choice.

Two of the procedures employed in the examination deserve further comment. Drying the tissue with compressed air readily allows the examiner to determine retraction of the gingival tissue from the teeth and the presence of interproximal soft tissue craters. Probing of only the mesial surfaces of the teeth offers several advantages. It is the most accessible tooth surface in the posterior segments of the mouth. Periodontal pocketing is found more frequently and is more severe on the proximal surfaces of the teeth. Training of examiners

to recognize the position of the C-E junction is minimized.

Assessment of tooth mobility, traumatic occlusion, and oral habits were purposely excluded from the examination because of difficulty in assessment and a lack of agreement between examiners. It cannot be denied that occlusal trauma accelerates gingival inflammation. Most of the evidence, however, contradicts the opinion that trauma from occlusion initiates gingivitis or periodontal pocket formation.

One important aspect of any procedure is its acceptance by the group for which it is intended. It is obvious that a relatively uncomplicated procedure, such as the method described, will be accepted more readily than more sophisticated procedures.

#### REFERENCES

1. Brekhus, P. J. Dental disease and its relation to the loss of human teeth. *J. Amer. Dent. Ass.* 18:2237 (Dec. 1929).
2. Allen, E. F. Statistical study of primary causes of extraction. *J. Dent. Res.* 23:453 (Dec. 1944).
3. Pelton, W. J., E. H. Pennell, and A. Drusina. Tooth morbidity experience of adults. *J. Amer. Dent. Ass.* 49:489 (Oct. 1954).
4. Moen, B. D. Survey of needs for dental care. II. Dental needs according to age and sex of patients. *J. Amer. Dent. Ass.* 46:200 (Feb. 1953).
5. Marshall-Day, C. D. The epidemiology of periodontal disease. *J. Periodont.* 22:13 (Jan. 1951).
6. Massler, M., I. Schour, and B. Chopra. Occurrence of gingivitis in suburban Chicago school children. *J. Periodont.* 21:146 (July 1950).
7. Goldman, H. M., and D. W. Cohen. *Periodontia*, 7th ed., p. 407. St. Louis: C. V. Mosby, 1957.
8. Orban, B., F. M. Wentz, F. G. Everett, and D. A. Grant. *Periodontics*, pp. 146-153. St. Louis: C. V. Mosby, 1958.
9. Glickman, I. *Clinical periodontology*, 2d ed., pp. 284-288. Philadelphia: W. B. Saunders, 1958.
10. Greene, J. C., and J. R. Vermillion. The oral hygiene index: A method for classifying oral hygiene status. *J. Amer. Dent. Ass.* 61:172 (Aug. 1960).
11. Greene, J. C. Periodontal disease in India: Report of an epidemiological study. *J. Dent. Res.* 39:302 (Mar.-Apr. 1960).
12. Glickman, I. *Clinical periodontology*, 2d ed., pp. 321-322. Philadelphia: W. B. Saunders, 1958.
13. Ramfjord, S. P. Indices for prevalence and incidence of periodontal disease. *J. Periodont.* 30:51-59 (Jan. 1959).
14. Marshall-Day, C. D., R. G. Stevens, and L. F. Quigley, Jr. Periodontal disease prevalence and incidence. *J. Periodont.* 26:185-203 (July 1955).
15. Russell, A. L. A system of classification and scoring for prevalence surveys of periodontal disease. *J. Dent. Res.* 35:350-359 (June 1956).
16. Black, A. D. Roentgenographic studies of tissues involved in chronic mouth infections. *Dent. Summary* 38:924 (1918).
17. Miller, S. C., and B. B. Seidler. Relative alveoloclastic experience of the various teeth. *J. Dent. Res.* 21:365-371 (Aug. 1942).
18. Marshall-Day, C. D., and K. L. Shourie. Roentgenographic survey of periodontal disease in India. *J. Amer. Dent. Ass.* 39:572 (Nov. 1949).

<p>USAF School of Aerospace Medicine, Brooks AFB, Tex.</p> <p>SAM-TDR-63-51. A SCREENING EXAMINATION FOR DETECTION OF GINGIVAL AND PERIODONTAL BREAKDOWN AND LOCAL IRRITANTS. July 63, 10 pp. incl. illus., tables, 18 refs.</p> <p>Unclassified Report</p> <p>Methods of detecting gingival and periodontal breakdown and periodontal irritants were studied: (1) With a comprehensive periodontal examination used as a criterion, three screening examinations for the detection of periodontal disorders were evaluated. Two systems, the "mesial" and the "mesial plus distal" proved 94.1 and 98.0% accurate. (2) By use of the mesial screening system, inter- and intra-</p>	<p>1. Periodontal disease</p> <p>2. Periodontal detection system</p> <p>I. AFSC Task 775602</p> <p>II. T. J. O'Leary, Lt. Col., USAF, DC, et al.</p> <p>III. In ASTIA collection</p>	<p>USAF School of Aerospace Medicine, Brooks AFB, Tex.</p> <p>SAM-TDR-63-51. A SCREENING EXAMINATION FOR DETECTION OF GINGIVAL AND PERIODONTAL BREAKDOWN AND LOCAL IRRITANTS. July 63, 10 pp. incl. illus., tables, 18 refs.</p> <p>Unclassified Report</p> <p>Methods of detecting gingival and periodontal breakdown and periodontal irritants were studied: (1) With a comprehensive periodontal examination used as a criterion, three screening examinations for the detection of periodontal disorders were evaluated. Two systems, the "mesial" and the "mesial plus distal" proved 94.1 and 98.0% accurate. (2) By use of the mesial screening system, inter- and intra-</p>	<p>1. Periodontal disease</p> <p>2. Periodontal detection system</p> <p>I. AFSC Task 775602</p> <p>II. T. J. O'Leary, Lt. Col., USAF, DC, et al.</p> <p>III. In ASTIA collection</p>
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